REMARKS

This application has been revised and the following remarks are submitted in light of the Office Action mailed February 7, 2005. Claims 1-51 are presented for examination. Claims 1 and 15 have been amended, and new Claims 50 and 51 have been added.

The claim amendments and new claims presented herein are fully supported by the specification as originally filed. Specifically, Claims 1 and 15 are supported by Figures 1-4 and corresponding description at paragraphs [0020]-[0028]. New Claims 50 and 51 are supported by original Claims 1 and 15, and by the specification at paragraph [0028]. No new matter has been added.

Rejection of Claims 1-6, 11, 13-18, 24, 27, 29-30, 31 and 32 under 35 U.S.C. 102(e) over Lui et al.

Claims 1-6, 11, 13-18, 24, 27, 29-30, 31 and 32 are rejected under 35 U.S.C. 102(e) over U.S. Patent No. 6,689,695 to Lui et al. Applicants respectfully traverse this rejection.

The Lui et al. patent issued from an application filed June 28, 2002, which is before the filing date of the present application. The invention claimed in the present application, however, was made prior to the filing date of the Lui et al. patent. Evidence of earlier invention is provided in the Declaration under 37 C.F.R. 1.131 which is submitted herewith. Specifically, the Declaration and attached SEM photomicrographs establish that the present invention was made prior to June 28, 2002. The Lui et al. patent is therefore not available as 102(e) prior art against the present application.

Accordingly, Applicants respectfully submit that Claims 1-6, 11, 13-18, 24, 27, 29-30 and 32 are not anticipated by Lui et al., and therefore request withdrawal of this rejection.

Rejection of Claims 7-8, 12, 20-23 and 28 under 35 U.S.C. 103(a) over Lui et al. in view of Bao et al.

Claims 7-8, 12, 20-23 and 28 are rejected under 35 U.S.C. 103(a) over Lui et al. in view of U.S. Patent Application Pub. No. 2004/008764 by Bao et al. Applicants respectfully traverse this rejection.

As discussed previously, the Lui et al. patent is not available as prior art against the present application, because the invention claimed in the present application was made prior to the filing date of the Lui et al. patent. Since the Bao et al. application was filed after the filing date of the Lui et al. patent, the Bao et al. application also is not available as prior art against the present application.

Accordingly, Applicants respectfully submit that Claims 7-8, 12, 20-23 and 28 are patentable over Lui et al. in view of Bao et al., and therefore request withdrawal of this rejection.

Rejection of Claims 9-10, 19 and 25-26 under 35 U.S.C. 103(a) over Lui et al. in view of Wolf

Claims 9-10, 19 and 25-26 are rejected under 35 U.S.C. 103(a) over Lui et al. in view of Wolf. Applicants respectfully traverse this rejection.

As discussed previously, the Lui et al. patent is not available as prior art against the present application, because the invention claimed in the present application was made prior to the filing date of the Lui et al. patent.

Initially, Applicants note that the Form PTO-892 accompanying the Office Action identifies two references authored by Wolf, and it is therefore unclear which Wolf reference is referred to in this rejection. Neither of the cited Wolf references, however, discloses or suggests the present invention.

Accordingly, Applicants respectfully submit that Claims 9-10, 19 and 25-26 are patentable over Lui et al. in view of Wolf, and therefore request withdrawal of this rejection.

Rejection of Claims 33-36, 42, 45 and 47-49 under 35 U.S.C. 103(a) over Daniels et al.

Claims 33-36, 42, 45 and 47-49 are rejected under 35 U.S.C. 103(a) over Daniels et al. Applicants respectfully traverse this rejection.

Claim 33 is directed to a method for forming a dual damascene interconnect structure on a semiconductor substrate comprising at least one patterned conductor. The method comprises the steps of: depositing a dielectric material on the substrate; forming at least one trench in the dielectric material, such that at least one of the trenches is positioned over the patterned conductor; depositing a layer of planarizing material on the dielectric material and in the trench; depositing a layer of barrier material on the layer of planarizing material; depositing at least one layer of imaging material on the layer of barrier material; forming at least one via in the layers of imaging material, barrier material and planarizing material, such that at least one of the vias is positioned over the trench and the patterned conductor; removing the imaging material, either after or concurrently with forming the via in the planarizing material; transferring the at least one via to the dielectric material, such that at least one of the vias is positioned over the trench and the patterned conductor; removing the barrier material, either after or concurrently with transferring the at least one via to the dielectric material; and removing the planarizing material. Thus, it is a feature of the present invention that a layer of barrier material is deposited on the layer of planarizing material, it is a further feature that at least one via is formed in the barrier material, and it is a further feature that this layer of barrier material is removed. Applicants respectfully submit that these features (at least) are neither disclosed nor suggested by Daniels et al., as follows.

The Daniels et al. patent is directed to a method of forming a microelectronic device. In the Office Action, it is correctly noted that Daniels et al. fails to disclose the steps of depositing a layer of barrier material on the layer of planarizing material, forming at least one via in the barrier material, and removing the barrier material.

Daniels et al. also fail to suggest these features of the present invention. The Daniels et al. barrier layer shown in Figure 6d and the first and second hardmask layers of Figure 11a do not suggest the barrier material of the present invention for the following reason. The barrier and hardmask layers of Daniels et al. are only partially removed, and therefore a significant portion of these layers remain in the final interconnect structure of Daniels et al. In contrast to Daniels et al., the barrier material of the present invention is a sacrificial material, and is therefore removed prior to completion of the interconnect structure. Removal of the barrier material is important because such barrier materials often have a higher dielectric constant than the interlayer dielectric material. In fact, the exemplary barrier materials of Daniels et al. (silicon nitride and silicon oxide) have a significantly higher dielectric constant, k, than their preferred low-k dielectric materials. In the present invention, the barrier material is completely removed, and therefore does not degrade the performance of the completed microelectronic device. Daniels et al. fail to recognize the importance of removing such barrier material, and therefore fail to suggest the above-identified features of the present invention.

Accordingly, Applicants respectfully submit that Claim 33 is patentable over Daniels et al. Claims 34-36, 42, 45 and 47-49, which depend from Claim 33, are also patentable over Daniels et al. Applicants therefore request withdrawal of this rejection.

Rejection of Claims 37 and 43-44 under 35 U.S.C. 103(a) over Daniels et al. in view of Wolf

Claims 37 and 43-44 are rejected under 35 U.S.C. 103(a) over Daniels et al. in view of Wolf. Applicants respectfully traverse this rejection.

Claims 37 and 43-44 each depend ultimately from Claim 33. It is a feature of Claim 33 that a layer of barrier material is deposited on the layer of planarizing material, it is a further feature that at least one via is formed in the barrier material, and it is a further feature that this layer of barrier material is removed.

Applicants respectfully submit that these features (at least) are neither disclosed nor suggested by Daniels et al. in view of Wolf, as follows.

As discussed previously, Daniels et al. fail to disclose or even suggest the above-identified features of the present invention. Wolf fails to remedy the deficiencies of the Daniels et al. patent. Neither of the cited Wolf references discloses depositing a layer of barrier material on a layer of planarizing material, forming at least one via in the barrier material, or removing a layer of barrier material. Wolf therefore fails to provide any motivation to modify the Daniels et al. patent in this regard.

Accordingly, Applicants respectfully submit that Claims 37 and 43-44, which depend from Claim 33, are patentable over Daniels et al. in view of Wolf, and therefore request withdrawal of this rejection.

Rejection of Claims 38-41 and 46 under 35 U.S.C. 103(a) over Daniels et al. in view of Wolf and Bao et al.

Claims 38-41 and 46 are rejected under 35 U.S.C. 103(a) over Daniels et al. in view of Wolf, and further in view of Bao et al. Applicants respectfully traverse this rejection.

Claims 38-41 and 46 each depend ultimately from Claim 33. It is a feature of Claim 33 that a layer of barrier material is deposited on the layer of planarizing material, it is a further feature that at least one via is formed in the barrier material, and it is a further feature that this layer of barrier material is removed. Applicants respectfully submit that these features (at least) are neither disclosed nor suggested by Daniels et al. in view of Wolf and Bao et al., as follows.

As discussed previously, Daniels et al. fail to disclose or even suggest the above-identified features of the present invention, Wolf fails to provide any motivation to modify the Daniels et al. patent in this regard, and Bao et al. is unavailable as prior art against the present invention.

Accordingly, Applicants respectfully submit that Claims 38-41 and 46, which depend from Claim 33, are patentable over Daniels et al. in view of Wolf and Bao et al., and therefore request withdrawal of this rejection.

Conclusion

Applicants have properly traversed each of the grounds for rejection in the Office Action, and therefore submit that the present application is now in condition for allowance. If the Examiner has any questions or believes further discussion will aid examination and advance prosecution of the application, a telephone call to the undersigned is invited.

No fee is believed to be due for the submission of this amendment. If any fees are required, however, the Commissioner is authorized to charge such fees to Deposit Account No. 09-0458.

Respectfully Submitted,

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